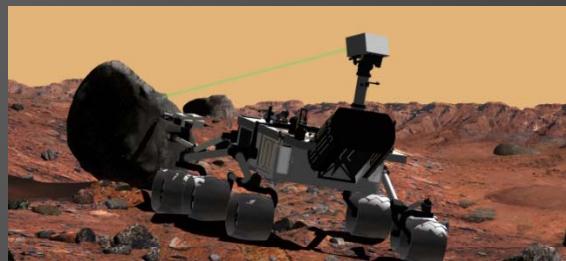
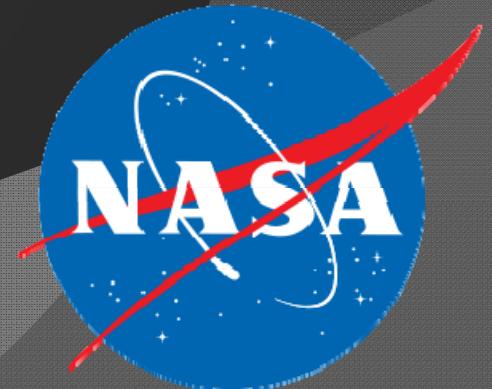


NASA IV&V Workshop 2012

A DATA OBJECT MODEL FOR IV&V ANALYSIS

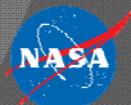


The MSL Experience



Developing a Data Object Model

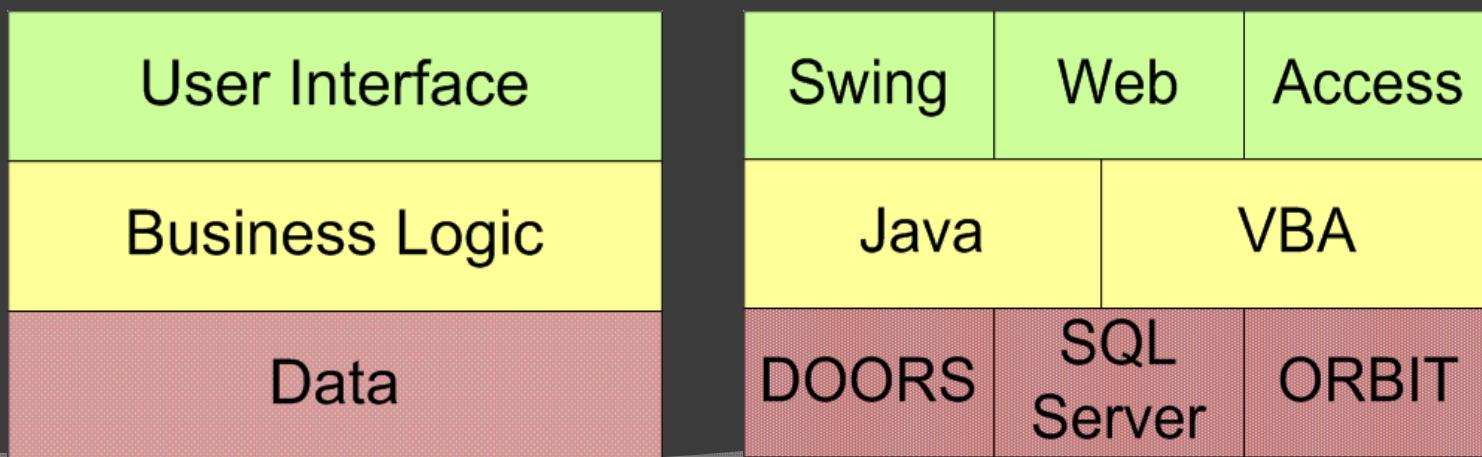
- Data Object Model – An implementation of the Data and Information Viewpoint (DIV) in DoDAF
- In support of the integrated analysis techniques being developed for the Mars Science Laboratory (MSL) IV&V project
- What we did on MSL
- What we could have done better
- Where we can take it



Independent Verification
and Validation Facility

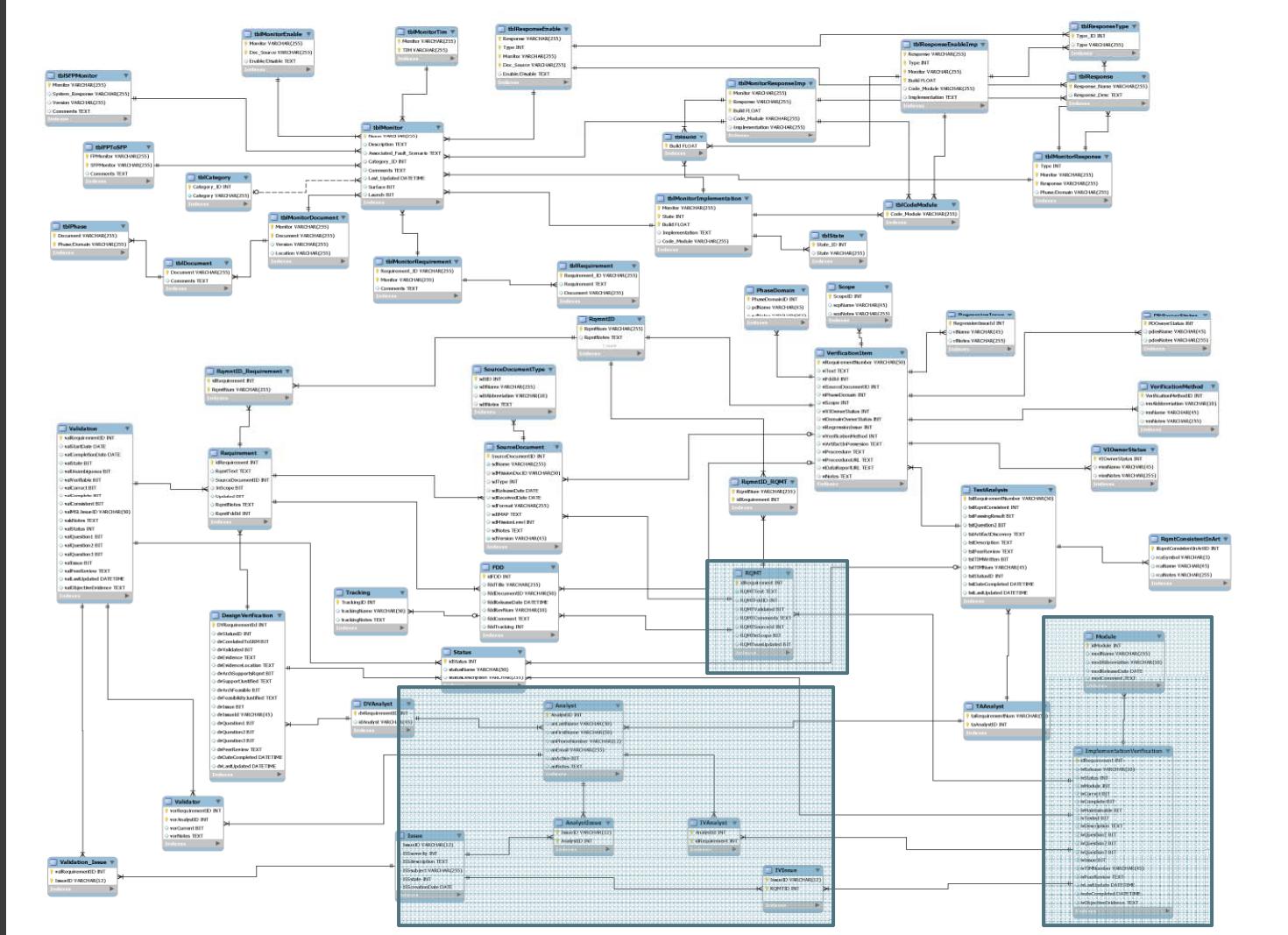
The Development Architecture

- Capture essential information from the integrated analysis
- Maintain data in a central repository
- Support multiple user interfaces (N-tier Development)



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and Validation Facility

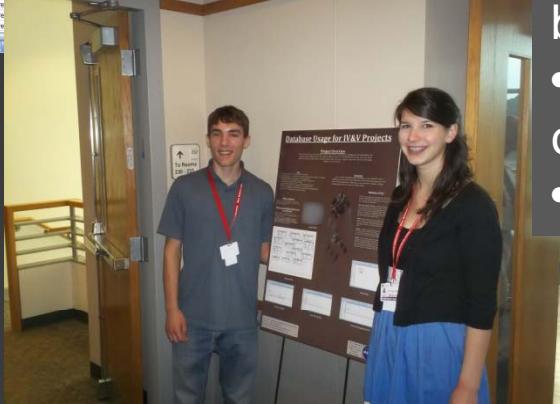
The Data Layer (SQL Server)



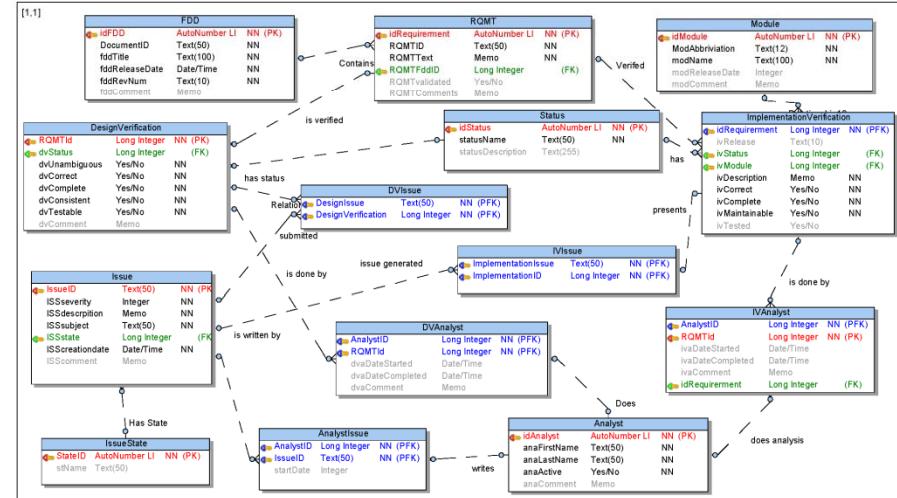
Capture the essential information

The screenshot shows a Microsoft Excel spreadsheet with a table containing requirements. The columns are labeled 'Date', 'Description', 'Implementation', and 'Issue'. The 'Implementation' and 'Issue' columns have sub-headings: 'Status' and 'Description'. The table is filled with rows of requirements, each with a unique ID and various status indicators (Y/N) and descriptions.

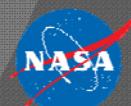
Data



What “Hidden” data,
such as status of the
analysis, is not on
the spreadsheet?



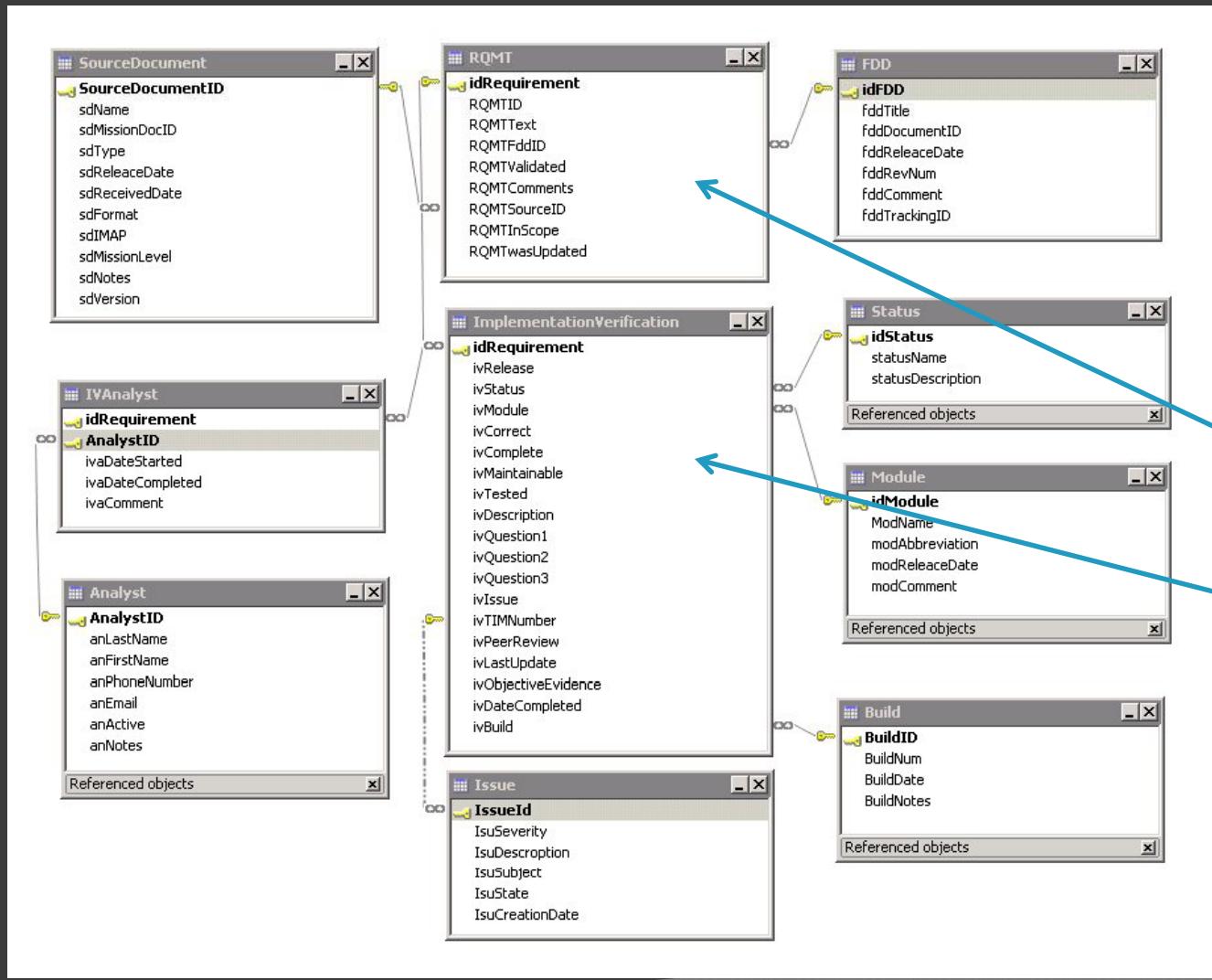
- “It depends on the business rules”
- Rules may affect any or all of the layers.
- Which rules define data?



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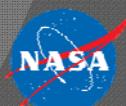
The SemanticAnalysis Object

The Data Layer



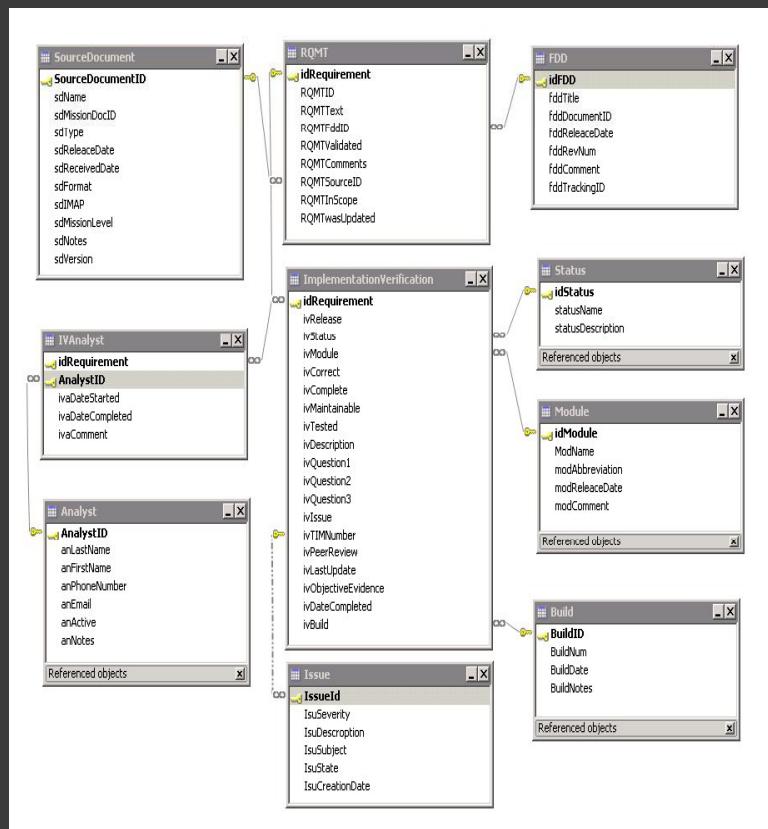
The object contains information about:

- The requirement being analyzed
- The analysis activity



The SemanticAnalysis Object

The Business Logic Layer



spGetSA

A set of stored procedures was written to facilitate object construction

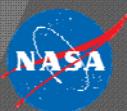
```
SemanticAnalysis
- idRequirement : int
- RqmtNum : string
- RqmtText : string
- FddId : int
- FddTitle : string
- SourceID : int
- InScope : bool
- WasUpdated : bool
- AnalystId : int
- AnalystFirst : string
- AnalystLast : string
- ivStatus : int
- statusName : string
- ivModule : int
- modName : string
- ivRelease : string
- buildNum : string
- ivBuild : int
- ivCorrect : bool
- ivComplete : bool
- ivMaintainable : bool
- ivTested : bool
- ivQuestion2 : bool
- ObjectiveEvidence : string
- AnalystFindings : string
- PeerReview : string
- ivIssue : bool
- ivTIMNNumber : string
- lastUpdated : Date
+ isEmpty() : bool
+ cancelChanges()
+ getSqlUpdate() : string
initializeChanged()
- setChanges()
- boolToInt(in b : bool) : int
- getSqlDate() : string
```

A lesson learned:

- The object is one of several analysis objects

- An abstract Analysis class should have been designed

- The class should have been decomposed and common items such as Analyst or FDD should be independent classes



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The SemanticAnalysis Object

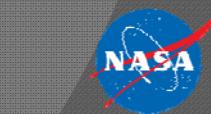
The User Interface Layer

SemanticAnalysis	
-idRequirement : int	
-RqmtNum : string	
-RqmtText : string	
-FddId : int	
-FddTitle : string	
-SourceID : int	
-InScope : bool	
-WasUpdated : bool	
-AnalystId : int	
-AnalystFirst : string	
-AnalystLast : string	
-ivStatus : int	
-statusName : string	
-ivModule : int	
-modName : string	
-ivRelease : string	
-buildNum : string	
-lvBuild : int	
-ivCorrect : bool	
-ivComplete : bool	
-ivMaintainable : bool	
-ivTested : bool	
-ivQuestion2 : bool	
-ObjectiveEvidence : string	
-AnalystFindings : string	
-PeerReview : string	
-ivIssue : bool	
-ivTIMNNumber : string	
-lastUpdated : Date	
+isEmpty() : bool	
+cancelChanges()	
+getSqlUpdate() : string	
-initializeChanged()	
-setChanges()	
-boolToInt(in b : bool) : int	
-getSqlDate() : string	

The class has been implemented in both Java, for a client for analysts, and Visual Basic for Applications, for an Access application to manage the database

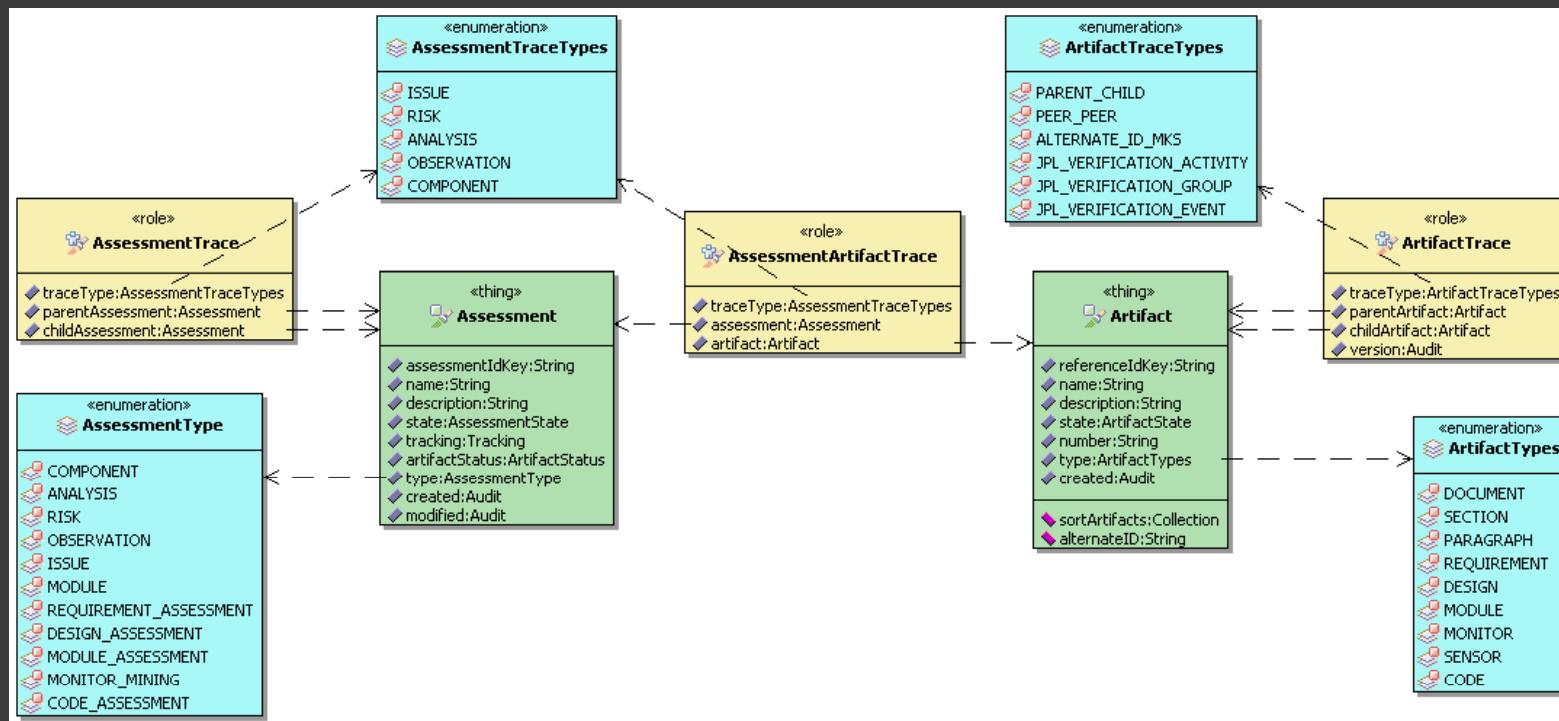
The screenshot shows the MSL Analysis Tracking Tool window. On the left, there's a panel titled "Analysis Information" containing a text box with analysis details and a table of requirements. In the center, a large box contains "Requirement Information" with a table of requirements. On the right, a vertical panel titled "Collection of SA objects" displays a table of semantic analysis objects.

Requirement ID	FDD	Module	Status	Release	Issue
F9W-MOB-101	mobility	imom	Complete	R10.2	No
F9W-MOB-102	mobility	imom	Complete	R10.1	No
F9W-MOB-103	mobility	imom	Complete	R10.1	No
F9W-MOB-104	mobility	imom	Complete	R9.1	No
F9W-MOB-105	mobility	imom	Complete	R10.2	No
F9W-MOB-106	mobility	imom	Complete	R10.2	No
F9W-MOB-107	mobility	imom	Complete	R10.2	No
F9W-MOB-108	mobility	imom	Complete	R10.2	No
F9W-MOB-109	mobility	imom	Complete	R10.3	No
F9W-MOB-110	mobility	imom	Complete	R10.2	No
F9W-MOB-111	mobility	imom	Complete	R10.2	No
F9W-MOB-112	mobility	imom	Complete	R10.2	No
F9W-MOB-113	mobility	imom	Complete	R10.2	No
F9W-MOB-114	mobility	imom	Complete	R10.2	No
F9W-MOB-115	Mobility				
F9W-MOB-116	Mobility				
F9W-MOB-301	mobility	imom	Complete	R10.1	No
F9W-MOB-302	mobility	imom	Complete	R10.1	No
F9W-MOB-303	mobility	imom	Complete	R10.1	No
F9W-MOB-304	mobility	imom	Complete	R10.1	No
F9W-MOB-305	mobility	imom	Complete	R10.1	No
F9W-MOB-306	Mobility				
F9W-MOB-307	mobility	imom	Complete	R10.1	No
F9W-MOB-308	Mobility				
F9W-MOB-309	mobility	imav	Complete	R10.1	No
F9W-MOB-310	mobility	imav	Complete	R10.1	No
F9W-MOB-311	mobility	imom	Complete	R10.1	No
F9W-MOB-312	mobility	imom	Complete	R10.1	No
F9W-MOB-313	mobility	imom	Complete	R10.2	No
F9W-MOB-314	mobility	imom	Complete	R10.2	No
F9W-MOB-315	mobility	imom	Complete	R10.2	No



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What an IV&V Domain Model Might Looks Like



Used by the SMAP team



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Benefits of a Domain Model

- Supports a common definition of the IV&V analysis data architecture.
- Provides building blocks for evidence based IV&V analysis.
- Encourages creation and reuse of analysis support utilities across technologies
- Leverages current IV&V technology investments



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Resources

- DoD Architecture Framework Ver. 2.02
Data and Information Viewpoint
(http://dodcio.defense.gov/dodaf20/dodaf20_data.aspx)
- NASA, Office of the Chief Information Officer: Enterprise Portfolio Management
(<http://www.nasa.gov/offices/ocio/portfolio/index.html>)
- The Java Tutorials: Object-Oriented Programming Concepts
(<http://docs.oracle.com/javase/tutorial/java/concepts/>)
- U.S Department of Defense, Chief Information Officer: Data Strategy Community of Interest
(<http://dodcio.defense.gov/CommunitiesofInterest/DataStrategyCOITraining.aspx>)



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